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INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 5 : A61M 5/32, 5/50

A1

(11) International Publication Number: WO 93/00950

(43) International Publication Date: 21 January 1993 (21.01.93)

(21) International Application Number: PCT/IT92/00072

(22) International Filing Date: 2 July 1992 (02.07.92)

(30) Priority data:
TO91A000526 5 July 1991 (05.07.91) IT

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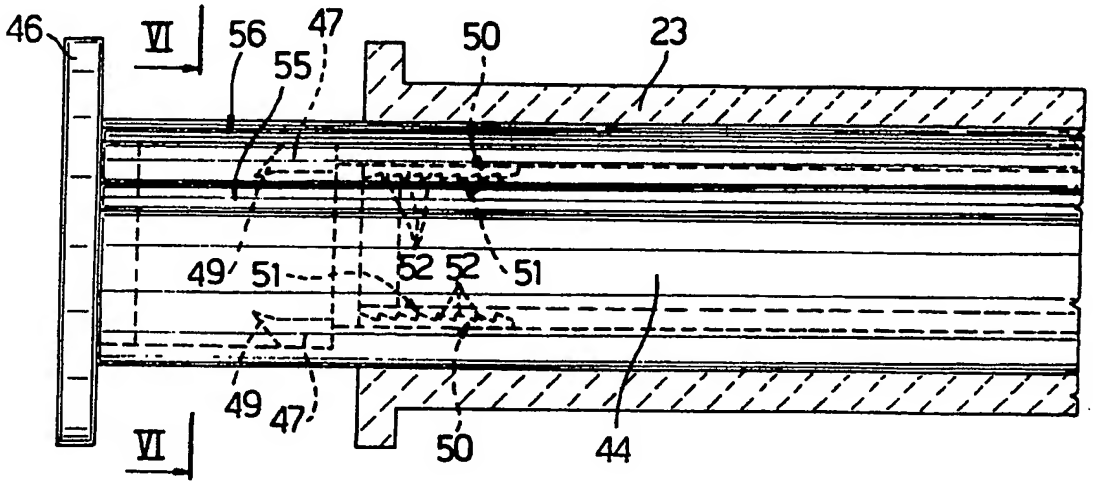
(81) Designated States: AT, AU, BB, BG, BR, CA, CH, CS, DE, DK, ES, FI, GB, HU, JP, KP, KR, LK, LU, MG, MN, MW, NL, NO, PL, RO, RU, SD, SE, US, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IT, LU, MC, NL, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, SN, TD, TG).

Published
With international search report.
Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.

(54) Title: DISPOSABLE SAFETY SYRINGE



(57) Abstract

A disposable safety syringe comprising a tubular body (32) defining a cavity (23) for therapeutic or physiological fluid; a hollow needle (18) fitted to a supporting element (15) connected to the body (32) in releasable manner and loaded by a spring (40) inwards of the body (32); a plunger (44) sliding inside the cavity (23) and designed, at the end of its travel, to release the supporting element (15) from the body (32); and constraint means (49, 51) between the plunger (44) and the body (32), active at least over the final portion of the compression stroke of the plunger (44), for preventing motion of the plunger (44) in the fluid intake direction.

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DESCRIPTION

DISPOSABLE SAFETY SYRINGE

TECHNICAL FIELD

The present invention relates to a disposable safety syringe for diagnostic or therapeutic purposes.

BACKGROUND ART

The risks involved in reusing syringes are well known.

Nevertheless, the design of conventional disposable syringes in no way provides for safely preventing them from being used again.

Disposable safety syringes have therefore been devised, as described for example in Italian Patent Application n. 67266-A/88 filed on 25 March 1988 by the present Applicants, whereby the plunger, close to the bottom limit position, activates a mechanism for axially releasing the needle, which, loaded by elastic means, is withdrawn inside the body of the syringe.

Though, by virtue of withdrawing the needle inside the body of the syringe after use, known syringes of the type briefly described above are undoubtedly effective in reducing contagion when handling the syringe after use, when disposing of hospital or medical refuse in

general, or due to inadvertent contact with syringes littering public premises, they present a major drawback in that they fail to provide for foolproof activation of the needle release mechanism. Known safety syringes in fact may actually be used again in the event of the user failing to push the plunger into the bottom limit position.

DISCLOSURE OF INVENTION

It is an object of the present invention to provide a disposable safety syringe designed to overcome the aforementioned drawback.

According to the present invention, there is provided a disposable safety syringe comprising:

- a tubular body defining a first cavity for therapeutic or physiological fluid;
- a hollow needle fitted to said body at least in the operating position of said syringe, and communicating with said first cavity at least in said position;
- a plunger sliding inside said first cavity, for aspirating or expelling said fluid through said needle;

characterized by the fact that it comprises first constraint means between said plunger and said body, said means being active at least along an end portion of the compression stroke of said plunger, for preventing said plunger from sliding in the fluid intake direction.

BRIEF DESCRIPTION OF DRAWINGS

A preferred, non-limiting embodiment of the present invention will be described by way of example with reference to the accompanying drawings, in which:

Fig.1 shows an axial section of a syringe in accordance with the present invention;

Fig.2 shows a section along line II-II in Fig.1;

Fig.s 3 and 4 show sections along line III-III in Fig.1 of the syringe in two different operating positions;

Fig.5 shows an enlarged, partially sectioned side view of a portion of the Fig.1 syringe;

Fig.s 6 and 7 show sections along line VI-VI in Fig.5 of the syringe in two different operating positions;

Fig.8 shows an enlarged axial section of the syringe, as in Fig.1, in a different operating position;

Fig.9 shows a longitudinal section of the syringe in a second operating position.

BEST MODE FOR CARRYING OUT THE INVENTION

With reference to Fig.s 1 and 8, number 1 indicates a syringe substantially comprising a main body 2 consisting of an intermediate annular flange 3 from the opposite ends of which there extend axially a truncated-cone-shaped head 4 and an elongated tubular portion 5.

Tubular portion 5 presents a circumferential groove 6 adjacent to flange 3; and, at groove 6, a radial through opening 7 of roughly 90°. The portion of

tubular portion 5 adjacent to flange 3 thus presents a substantially C-shaped section, as shown clearly in Fig.s 3 and 4.

The free end 8 of tubular portion 5 is closed by a plug 9 fitted, e.g. welded, inside portion 5.

Main body 2 defines an inner cavity 10 having a first portion 11 extending partly inside head 4 and partly inside tubular portion 5; and a second portion 12 extending along the remaining portion of tubular portion 5, having a larger inside diameter than first portion 11, and defined in relation to portion 11 by an inner shoulder 13 of tubular portion 5. Cavity 10 communicates externally via an axial hole 14 through head 4.

The edge of flange 3, which conveniently presents a locating recess 21, is fitted (e.g. welded) with a tubular barrel 22 extending coaxially with tubular portion 5 with which it defines an annular chamber 23, and terminating in an outer flange 31 as on normal syringes.

Main body 2 and barrel 22 combine to define body 32 of syringe 1.

Main body 2 houses an axially-sliding piston 15 comprising a rod 16 with an axial hole 17 at the end fitted integral with a normal hollow needle 18; and a cylindrical head 19 at the opposite end.

Piston 15 is fitted inside the bottom of cavity 10 so that needle 18 projects through hole 14, rod 16 cooperates axially with bottom wall 20 of cavity 10, and

head 19 is housed inside portion 12 of cavity 10. On the end fitted with needle 18, rod 16 presents a longitudinal groove 24 (Fig.2) cooperating with a longitudinal projection 25 formed on head 4 inside portion 11 of cavity 10, for angularly arresting piston 15 in relation to main body 2.

Rod 16 also presents two small, axially-spaced, annular projections 26 cooperating in airtight manner with the inner wall of portion 11 of cavity 10 in main body 2.

A radial opening 27 formed on rod 16 between projections 26 connects axial hole 17 and consequently the inner cavity of needle 18 to a radial through opening 28 formed in tubular portion 5 adjacent to opening 27.

Piston 15 is normally maintained in the above position by a retaining ring 29 having a radial opening 30, and two triangular inner teeth 34 on either side of opening 30. Ring 29 presents a flat face 35 cooperating in use with flange 3; and an opposite face 36 having a peripheral annular projection 37 defined internally by a flared conical annular surface 38. Ring 29 is fitted inside groove 6 of main body 2 so that teeth 34 fit inside body 2 through opening 7 and engage a tangential groove 39 on rod 16.

A spiral spring 40 is fitted inside portion 12 of cavity 10, coaxial with rod 16, and compressed between shoulder 13 and cylindrical head 19 of piston 15.

Finally, syringe 1 comprises a tubular plunger 44 sliding inside chamber 23, having a conical front surface 45, and fitted on the opposite end with a pressure disk 46.

Close to pressure disk 46, plunger 44 presents two diametrically-opposed inner projections 47 having respective shallow axial ledges 48, and terminating rearwards in respective flexible, substantially triangular teeth 49 facing inwards of plunger 44 and towards pressure disk 46.

The free end 8 of tubular portion 5 of main body 2 presents two longitudinal grooves 50 engaged by projections 47 under particular operating conditions described in detail later on. Grooves 50 present a toothed bottom surface 51 defined by a number of serrated projections 52 sloping slightly on the side facing the end of portion 5, and much more sharply on the opposite side, so as to define with teeth 49 a ratchet device permitting one-way motion of plunger 44 inwards of chamber 23.

Plunger 44 presents two shallow, rounded, outer longitudinal grooves 55, 56 selectively engaged by a longitudinal inner rib 57 on barrel 22, for achieving two different angular positions of plunger 44 in relation to barrel 22 and, therefore, to integral main body 2 (Fig.s 6 and 7). Passage from one angular position to the other is made possible by virtue of the elasticity of the materials employed.

In a first of said positions (Fig.7), projections 47 of plunger 44 are angularly offset in relation to grooves 50, so that ledges 48 of projections 47 cooperate axially with end surface 58 of tubular portion 5.

In the second position (Fig.6), projections 47 are aligned with respective grooves 50.

Syringe 1 operates as follows.

Syringe 1 is assembled and sold with plunger 44 in the angular position shown in Fig.7, wherein it presents a minimum axial length by virtue of projections 47 contacting end surface 58 of tubular portion 5 of main body 2, and wherein fluid may be aspirated by withdrawing plunger 44 in the usual manner. The aspirated fluid flows through needle 18, opening 27 in piston 15, and opening 28 in tubular portion 5 into annular chamber 23. The same angular position of plunger 44 also provides for expelling part of the fluid, which flows back along the same route, as well as for aspirating further fluid, even several times, thus enabling therapeutic fluids or powdered substances to be mixed or dissolved.

For injecting and expelling all the aspirated fluid, plunger 44 must be set to the angular position shown in Fig.6, wherein projections 47 are aligned with respective grooves 50.

For the first part of the compression stroke of plunger 44, operation is as described above, and plunger 44 may still be inverted.

The fluid is forced from chamber 23 into needle 18 through openings 28 and 27.

As plunger 44 nears the end of its travel, conveniently a few millimetres short of the bottom limit position, projections 47 engage respective grooves 50, and teeth 49 slide unidirectionally over toothed surfaces 51, any inversion of plunger 44 being prevented by teeth 49 engaging the steeper sides of teeth 52.

The above constraint thus provides for preventing syringe 1 from being reused, by virtue of preventing plunger 44 from being withdrawn for aspirating further fluid.

Over the final part of its travel (Fig.8), front surface 45 of plunger 44 contacts conical surface 38 of ring 29, which flexes outwards as shown in Fig.4, and teeth 34 of ring 29 free groove 39 of piston 15, which is thus clicked inside tubular portion 5 by spring 40.

Fig.8 shows the position prior to engagement, wherein ring 29 is parted by plunger 44; and Fig.9 the engaged position, wherein spring 40 maintains piston 15 and connected needle 18 housed entirely inside tubular portion 5 of main body 2.

The advantages of syringe 1 according to the present invention will be clear from the foregoing description.

Firstly, it provides for one-way travel of plunger 44 over the final part of the compression stroke, thus preventing the syringe from being reused by virtue of preventing further fluid from being aspirated. Secondly, following injection of the fluid, the needle is withdrawn entirely inside the body of the syringe, thus enabling safe handling of the syringe, particularly by refuse workers, and preventing inadvertent contact with potentially infected needles discarded on public premises.

Finally, provision is made for angularly rotating the plunger in relation to the body of the syringe, for switching from a position wherein access of the plunger to the final (one-way) portion of its travel is prevented, to an operating position wherein access is permitted. The first of said positions thus provides for successively aspirating and expelling the fluid with no danger of activating the one-way lock on the plunger or withdrawing the needle.

To those skilled in the art it will be clear that changes may be made to syringe 1 as described and illustrated herein without, however, departing from the scope of the present invention.

In particular, any number of changes may be made to the one-way constraint of plunger 44, or to the device for arresting piston 15.

CLAIMS

1) A disposable safety syringe (1) comprising:

- a tubular body (32) defining a first cavity (23) for therapeutic or physiological fluid;

- a hollow needle (18) fitted to said body (32) at least in the operating position of said syringe (1), and communicating with said first cavity (23) at least in said position;

- a plunger (44) sliding inside said first cavity (23), for aspirating or expelling said fluid through said needle (18);

characterized by the fact that it comprises first constraint means (49, 51) between said plunger (44) and said body (32), said means being active at least along an end portion of the compression stroke of said plunger (44), for preventing said plunger (44) from sliding in the fluid intake direction.

2) A syringe as claimed in Claim 1, characterized by the fact that it comprises an element (15) for supporting said needle (18) and sliding inside said body (32); stop means (29) for securing said supporting element (15) in releasable manner to said body (32) in said operating position; and elastic means (40) for forcing said supporting element (15) in such a direction as to withdraw said needle (18) inside said body (32); said plunger (44) cooperating with said stop means (29)

close to the end of its travel, for releasing said means (29) arresting said supporting element (15).

3) A syringe as claimed in Claim 1 or 2, characterized by the fact that said needle (18) and said first cavity (23) are coaxial.

4) A syringe as claimed in Claim 2 or 3, characterized by the fact that said body (32) of said syringe (1) comprises a main body (2) having a second inner cavity (10) and an axial hole (14) at the end housing said needle (18); and a tubular outer barrel (22) coaxial with said main body (2); said element supporting said needle (18) consisting of a piston (15) housed in sliding manner inside said second cavity (10); said first cavity (23) having an annular section and extending between said barrel (22) and a tubular portion (5) of said main body (2).

5) A syringe as claimed in Claim 3, characterized by the fact that said means for arresting said piston (15) comprise an elastic element (29) on said main body (2), located close to the bottom limit position of said plunger (44); said element (29) cooperating with locating means (39) on said piston (15), and being flexed and released by said plunger (44).

6) A syringe as claimed in Claim 5, characterized by the fact that said elastic element consists of a retaining ring (29) housed in said first cavity (23) and engaging an annular groove (6) on said main body (2); said locating means comprising a transverse groove (39)

on said piston (15) engaged by at least one inner tooth (34) on said ring (29) via a lateral opening (7) in said main body (2); said plunger (44) presenting a conical front surface (45) cooperating with a corresponding conical surface (38) of said ring (29) for parting said ring (29) and extracting said tooth (34) from said groove (39) on said piston (15).

7) A syringe as claimed in one of the foregoing Claims, characterized by the fact that it comprises second constraint means (47, 50) between said plunger (44) and said body (32), for enabling access by said plunger (44) to said end portion of said compression stroke in at least one predetermined angular position.

8) A syringe as claimed in any one of the foregoing Claims, characterized by the fact that said first constraint means comprise at least one surface (51) with serrated teeth (52), and at least one respective flexible tooth (49), formed respectively on said plunger (44) and said body (32) or vice versa; said tooth (49) sliding unidirectionally over said serrated surface (51).

9) A syringe as claimed in Claim 7 or 8, characterized by the fact that said second constraint means comprise at least one projection (47), and a respective longitudinal groove (50), formed respectively on said plunger (44) and said body (32) or vice versa.

10) A syringe as claimed in Claim 9, characterized by the fact that said flexible tooth (49) is formed on

said projection (47); and said serrated surface (51) is formed in said groove (50).

11) A syringe as claimed in one of the foregoing Claims from 7 to 10, characterized by the fact that it comprises third constraint means (55, 56, 57) between said plunger (44) and said body (32), for defining two preferential angular positions; a first preferential angular position being that wherein said syringe (1) is assembled and sold; and a second preferential position coinciding with said predetermined angular position.

12) A syringe as claimed in Claim 11, characterized by the fact that said third constraint means comprise a longitudinal rib (57) formed on said body (32), and two grooves (55, 56) formed on said plunger (44) or vice versa; said grooves (55, 56) being engaged selectively by said rib (57).

13) A disposable safety syringe, substantially as described and illustrated herein with reference to the accompanying drawings.

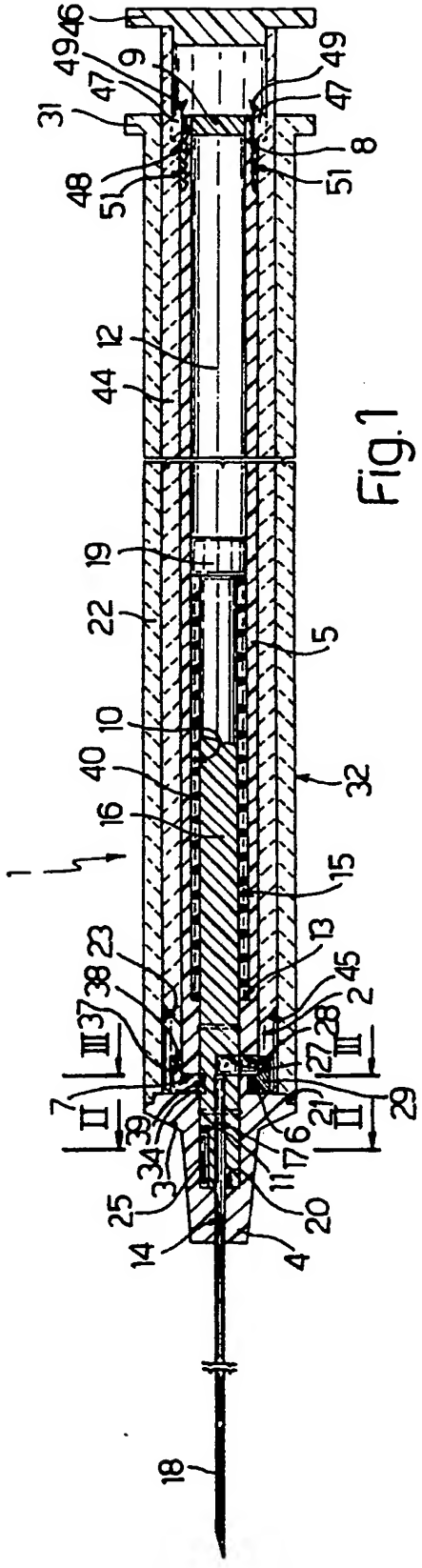


Fig.1

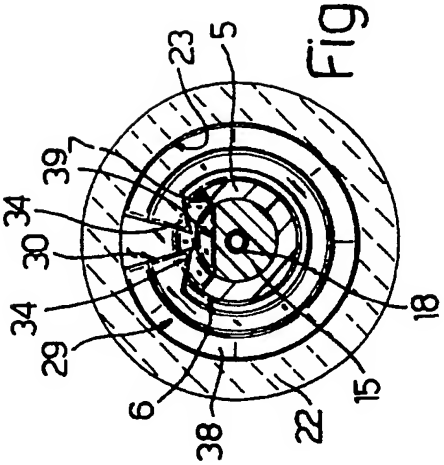


Fig.4

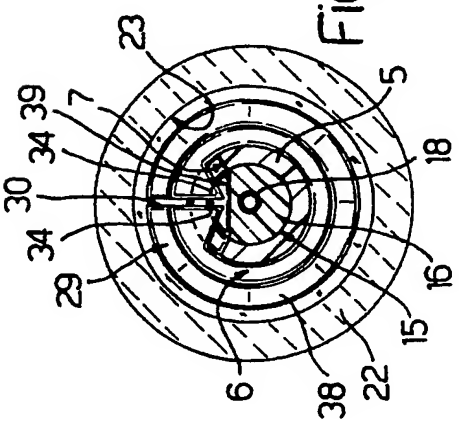


Fig 3

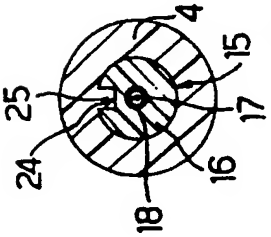


Fig. 2

Fig.5

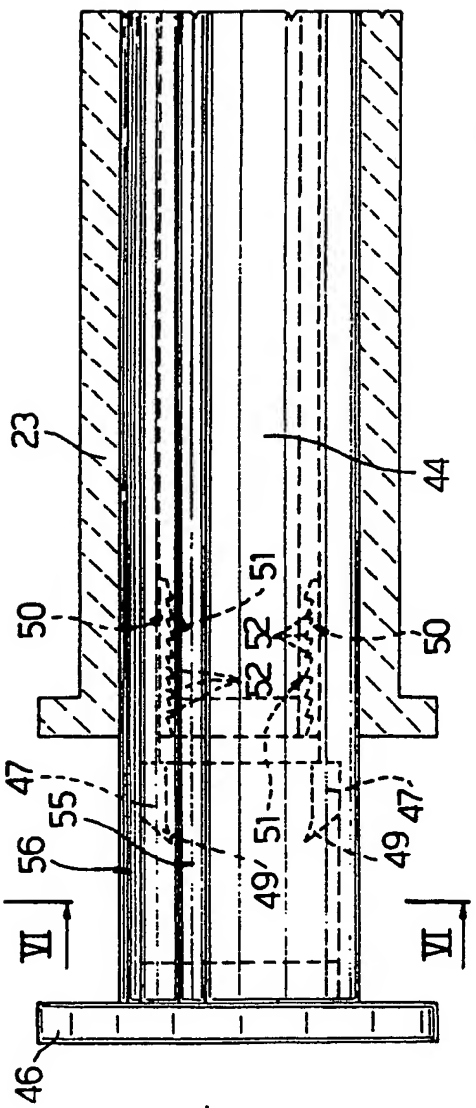


Fig.7

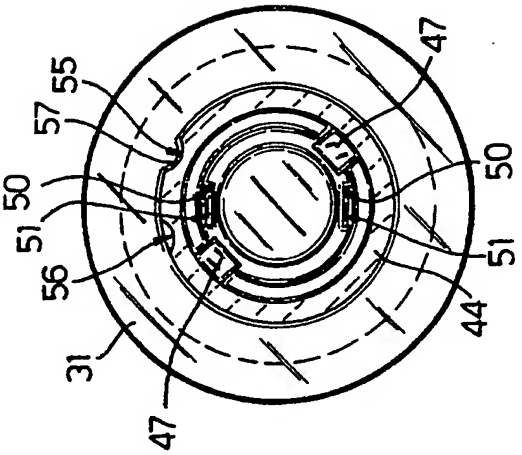
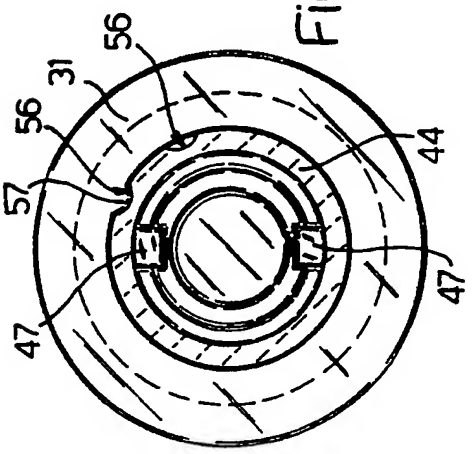


Fig.6



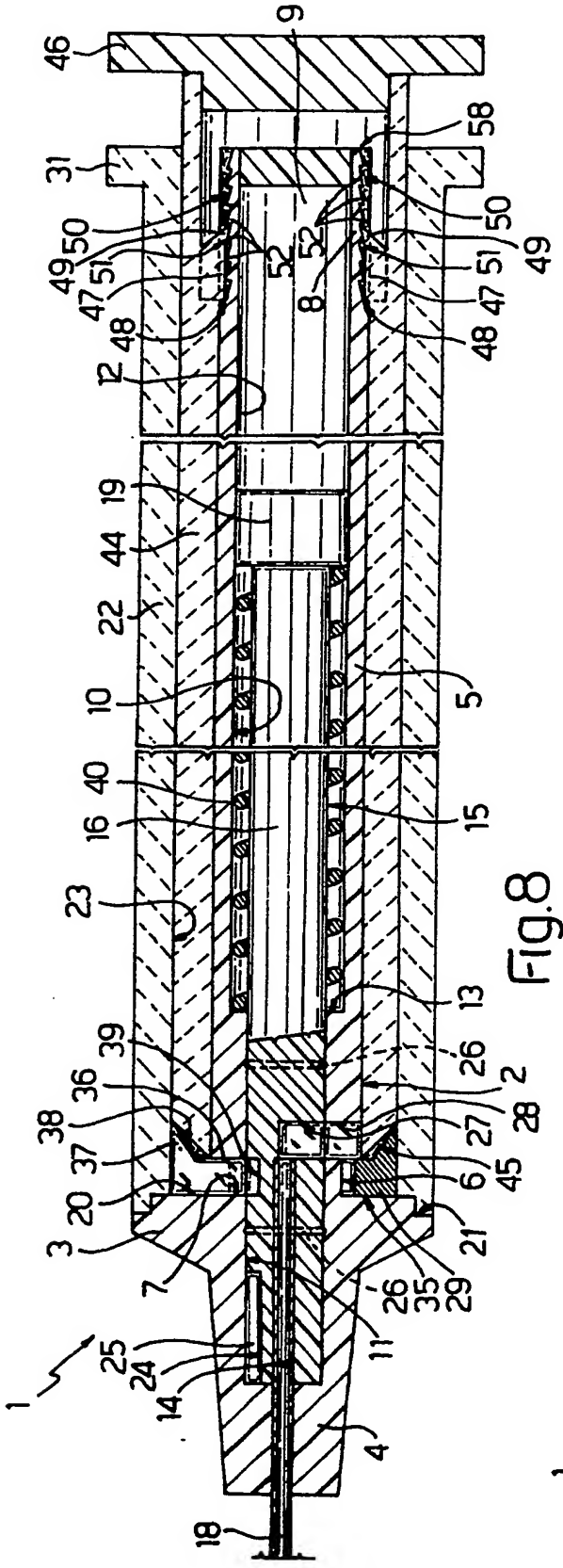

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Fig.8

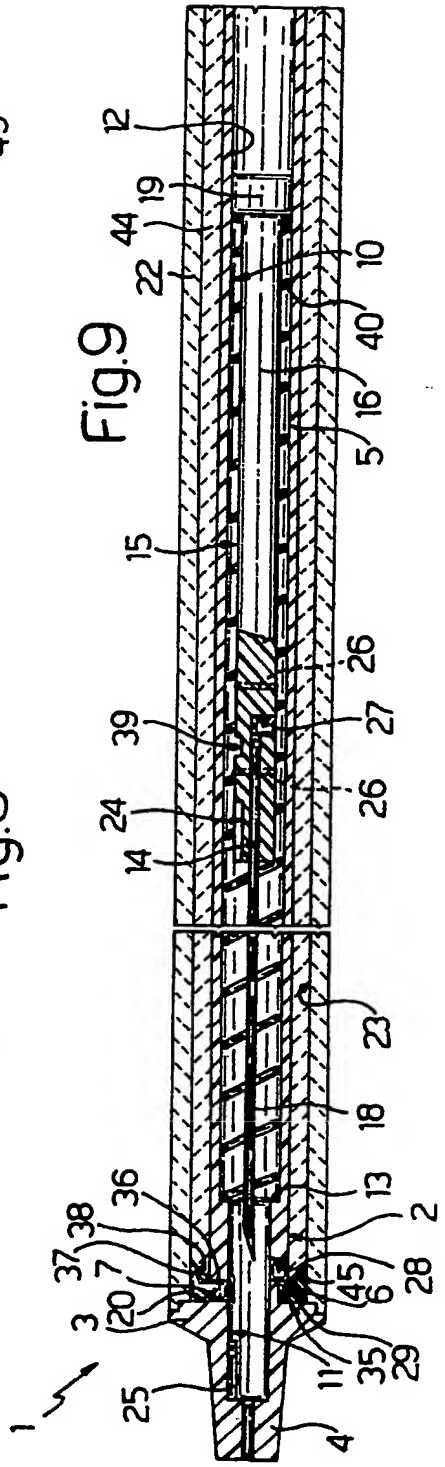
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Fig.9

INTERNATIONAL SEARCH REPORT

International Application No PCT/IT 92/00072

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all)[6]

According to International Patent Classification (IPC) or to both National Classification and IPC

Int.Cl.5 A 61 M 5/32 A 61 M 5/50

II. FIELDS SEARCHED

Minimum Documentation Searched[7]

Classification System	Classification Symbols
Int.Cl.5	A 61 M

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched[8]

III. DOCUMENTS CONSIDERED TO BE RELEVANT[9]

Category °	Citation of Document, [11] with indication, where appropriate, of the relevant passages [12]	Relevant to Claim No.[13]
X	GB,A,2203047 (BANKS) 12 October 1988, see page 5, lines 1-6; page 5, line 20 - page 6, line 18; figures 1-3	1,7,9-12
Y		2,3,5
A		8

Y	US,A,4838869 (ALLARD) 13 June 1989, see column 2, lines 32-36; column 3, lines 2-5; figure 3	2,3,5
A		4,6
	--- -/-	

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IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
02-11-1992	16. 11. 92
International Searching Authority	**Signature of Authorized Officer**
EUROPEAN PATENT OFFICE	R. SEDY

III. DOCUMENTS CONSIDERED TO BE RELEVANT (CONTINUED FROM THE SECOND SHEET)

Category °	Citation of Document, with indication, where appropriate, of the relevant passages	Relevant to Claim No.
A	US,A,5017187 (SULLIVAN) 21 May 1991, see column 3, lines 17-22; figures 2-4 ---	2-4,6
A	WO,A,9007948 (CARALT BATLLE) 26 July 1990, see page 11, line 26 - page 12, line 8; figures 2,3 ---	2,3,5,6
A	WO,A,9007350 (MÜLLER) 12 July 1990, see page 6, line 26 - page 7, line 5; figures 6,15 -----	2

ANNEX TO THE INTERNATIONAL SEARCH REPORT ON INTERNATIONAL PATENT APPLICATION NO. IT 9200072

SA 63354

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report. The members are as contained in the European Patent Office EDP file on 11/11/92
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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
GB-A- 2203047	12-10-88	US-A- 4840616	20-06-89
		US-E- RE33821	11-02-92
US-A- 4838869	13-06-89	None	
US-A- 5017187	21-05-91	None	
WO-A- 9007948	26-07-90	AU-A- 4959690	13-08-90
		EP-A- 0438368	24-07-91
WO-A- 9007350	12-07-90	AU-A- 4821190	01-08-90